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Pancasila as the Basic Values in Science and Technology Development Strategy in Indonesia

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Abstrak

Tujua- Penelitian ini bertujuan untuk mengeksplorasi penerapan nilai-nilai Pancasila dalam konteks pengembangan ilmu pengetahuan dan teknologi di Indonesia. Fokus utamanya adalah bagaimana Pancasila dapat menjadi landasan filosofis sekaligus pedoman etis dalam mengarahkan inovasi dan kemajuan teknologi agar selaras dengan karakter bangsa.Metodologi Penelitian / Desain / Pendekatan-Metode yang digunakan dalam penelitian ini adalah kajian literatur. Pendekatan ini dilakukan dengan menganalisis berbagai sumber yang membahas hubungan antara nilai-nilai Pancasila dan pengembangan ilmu pengetahuan serta teknologi di Indonesia. Temuan-Hasil analisis menunjukkan bahwa Pancasila tidak hanya berfungsi sebagai dasar filosofis, tetapi juga sebagai panduan etis dalam inovasi dan pengembangan teknologi. Nilai-nilai seperti keadilan sosial, persatuan, serta kemanusiaan yang adil dan beradab menjadi kriteria penting dalam menentukan arah dan dampak pembangunan teknologi. Orisinalitas /Nilai-Penelitian ini menekankan pentingnya mengintegrasikan nilai-nilai Pancasila pada setiap tahap pengembangan ilmu pengetahuan dan teknologi agar sejalan dengan kebutuhan masyarakat dan karakter bangsa Indonesia. Temuan ini memberikan kontribusi strategis bagi pembuat kebijakan dan inovator untuk memprioritaskan aspek moral dan sosial dalam kemajuan teknologi.

Kata kunci: *Pancasila, nilai-nilai dasar, pengembangan ilmu pengetahuan dan teknologi*

Abstract

Purpose -This study aims to explore the application of Pancasila values in the context of the development of science and technology in Indonesia. The main focus is how Pancasila can be a philosophical foundation as well as an ethical guideline in directing innovation and technological progress in accordance with the character of the nation. Research Methodology / Design / Approach -The method used in this study is a literature review. This approach involves analyzing various sources that discuss the relationship between Pancasila values and the development of science and technology in Indonesia. Findings -The results of the analysis show that Pancasila not only functions as a philosophical basis but also as an ethical guide in innovation and technological development. Values such as social justice, unity, and just and civilized humanity are important criteria in determining the direction and impact of technological development. Originality / Value- This study emphasizes the importance of integrating Pancasila values at every stage of the development of science and technology in order to align with the needs of society and the character of the Indonesian nation. These findings provide a strategic contribution for policy makers and innovators to prioritize moral and social aspects in technological progress.

Keywords: *Pancasila, basic values, science and technology development*

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Introduction

Pancasila is constitutionally positioned as the philosophical foundation of the Indonesian state and a normative compass for national development, including the direction of education, science, and technology. As articulated in the Preamble of the 1945 Constitution, the Indonesian state is mandated to protect the whole nation, advance public welfare, educate the life of the people, and contribute to global peace objectives that implicitly demand that scientific progress and technological modernization remain aligned with human dignity, social justice, and national unity (Republik Indonesia, 1945). In contemporary governance, this constitutional mandate is operationalized through policies that emphasize science and technology (S&T) not merely as engines of economic growth, but as instruments for sustainable national development, societal well-being, and the protection of local wisdom and traditional knowledge (Republik Indonesia, 2019).

However, the acceleration of digital transformation particularly in artificial intelligence (AI), big data, platform economies, and ubiquitous connectivity has introduced a new set of ethical and socio-political dilemmas. Globally, governance debates increasingly recognize that innovation is never value-neutral; technological systems can reproduce inequality, distort accountability, amplify bias, and create new forms of exclusion if they are designed and deployed without explicit ethical guardrails (OECD, 2019; UNESCO, 2021). Responsible innovation scholarship similarly argues that innovation must be guided by anticipatory, reflective, deliberative, and responsive practices so that scientific and technological advances remain socially desirable and ethically acceptable (Stilgoe et al., 2013). From this perspective, the central question for Indonesia is not whether S&T should be advanced, but how S&T advancement can be structured so that it strengthens national character, social cohesion, and distributive justice core aspirations embedded in the values of Pancasila.

In Indonesia, this normative imperative is strengthened by the legal architecture of the national science and technology system. Law No. 11 of 2019 explicitly defines the National System of Science and Technology as being grounded in principles that include humanity, justice, transparency, accessibility, and respect for traditional knowledge and local wisdom elements that are highly congruent with Pancasila's ethical orientation (Republik Indonesia, 2019). The same law frames S&T advancement as a means to enhance sustainable national development, improve quality of life, and increase social welfare thereby positioning ethical and societal outcomes as integral to innovation policy rather than as afterthoughts (Republik Indonesia, 2019). Institutional reforms also reflect this orientation, for example through the strengthening of the National Research and Innovation Agency (BRIN), which is mandated to integrate research and innovation governance nationally in ways that reflect the national ideological direction (Republik Indonesia, 2021). At the level of development planning, Indonesia's medium-term development agenda (RPJMN 2020–2024) highlights the strategic role of innovation capability and S&T adoption in achieving national priorities, indicating that S&T governance is inseparable from broader state objectives (Kementerian PANRB, 2020; Bappenas, 2020).

Despite these policy commitments, translating Pancasila values into actionable S&T development strategies remains challenging. Technological innovation often progresses faster than ethical and regulatory adaptation, while market-driven incentives can prioritize short-term efficiency over fairness, inclusivity, and long-term societal resilience. Moreover, the diffusion of ICT and digital infrastructures brings both opportunities and risks: connectivity can enable remote communities to participate in global networks and access new services, yet it may also generate cultural tensions and anxieties about the erosion of community norms and identity when technological change is not socially embedded (Hossain, 2019). These tensions echo a broader problem identified in global digital governance: ethical frameworks are widely endorsed, but implementation frequently lags behind, particularly in areas such as accountability, equity, and protection of vulnerable groups (OECD, 2019; UNESCO, 2021).

Existing scholarship in Indonesia has frequently approached Pancasila and S&T as a normative relationship emphasizing Pancasila as a "guiding star" to prevent the misuse of science

and technology and to ensure that technological progress remains beneficial for humanity (Amelia et al., 2022). Other discussions highlight the need to align emerging technologies, including AI, with Pancasila-based ethical reasoning so that innovation trajectories do not undermine social justice and national identity (Yudiono, 2025). Yet, a recurring limitation in this literature is that Pancasila is often treated as a general moral statement rather than being translated into a strategy framework that can inform policy instruments, research governance, innovation evaluation criteria, and technology deployment standards. In other words, the gap is not the absence of values, but the shortage of operational mechanisms that connect values to measurable governance practices across the S&T lifecycle.

Therefore, this study positions Pancasila as the basic values framework for Indonesia's science and technology development strategy by asking: How can Pancasila be operationalized into strategic principles and governance mechanisms that guide S&T development toward ethical acceptability, sustainability, and social justice outcomes? Building on responsible innovation perspectives (Stilgoe et al., 2013) and global AI ethics frameworks (OECD, 2019; UNESCO, 2021), this paper develops a conceptual and strategic synthesis that (1) maps the relevance of Pancasila's core values to contemporary S&T and AI governance challenges; (2) identifies key implementation tensions (e.g., market pressures, institutional fragmentation, value trade-offs in technology design and deployment); and (3) proposes policy and practice-oriented recommendations for embedding Pancasila values into the governance of research agendas, innovation incentives, evaluation metrics, and public accountability mechanisms within Indonesia's national innovation ecosystem (Republik Indonesia, 2019, 2021).

By doing so, the study contributes to both national and international conversations on values-based technology governance. Nationally, it clarifies how Pancasila can function not only as a philosophical foundation but also as a practical strategy framework for S&T governance aligned with Indonesia's legal and institutional reforms (Republik Indonesia, 2019, 2021). Internationally, it offers an example of how local constitutional ideology can be leveraged as a culturally grounded ethical framework that complements global principles of trustworthy and human-centered innovation (OECD, 2019; UNESCO, 2021). Ultimately, the paper argues that positioning Pancasila as the basic values in S&T strategy is essential to ensure that Indonesia's technological advancement remains not only technically robust, but also socially legitimate, culturally embedded, and just.

Method

This study uses a literature review to explore the role of Pancasila as a basic values framework for Indonesia's science and technology development strategy. The process was conducted transparently through stages of searching, selecting, analyzing, and synthesizing the literature to support replicability (Grant & Booth, 2009). Data sources were drawn from relevant scholarly articles and academic books, as well as official policy documents such as laws, regulations, and national development plans because the topic is closely linked to governance and the state's ideological direction (Page et al., 2021). The literature was selected based on its relevance to the relationship between Pancasila and science and technology development and on the credibility of the publisher or issuing institution; duplicate sources, materials unrelated to the research focus, and opinion-based texts lacking an evidence base were excluded. The data were then analyzed using thematic analysis by coding key arguments and grouping them into major themes, including how Pancasila values can be operationalized in science and technology development, implementation challenges, and recommended practices or policy instruments (Braun & Clarke, 2006). Finally, the findings were synthesized into a structured narrative outlining strategic implications for stakeholders; because the study relies solely on publicly available documents and does not involve human participants, formal ethical approval was not required.

Findings and discussion

Pancasila as a Values Foundation for Science and Technology Development

The findings indicate that Pancasila, as Indonesia's state ideology and philosophical foundation, provides a robust values framework for guiding science and technology (S&T) development. Its five principles Belief in One Supreme God, Just and Civilized Humanity, the Unity of Indonesia, Democracy Guided by Inner Wisdom through Deliberation and Representation, and Social Justice for All Indonesians can function as ethical guidelines across the technology lifecycle, from design and production to deployment and impact evaluation. This orientation matters because the success of innovation should not be assessed only by technical efficiency or economic returns, but also by its social value and contribution to public welfare (Trajtenberg, 1989).

Embedding Pancasila values in technology development can support inclusive and sustainable innovation by prioritizing human dignity, equitable distribution of benefits, and the public interest. In this context, the principle of national unity can be translated into efforts to strengthen interregional connectivity and reduce access gaps, while social justice implies that technological benefits should reach marginalized groups so that progress does not become uneven. Conceptually, the practical actualization of Pancasila is also essential to maintain the consistency, relevance, and contextual fit of these values amid rapid socio-technological change (Karimullah, 2023). At the same time, the review highlights that Pancasila values are not always fully implemented in practice. In some cases, technology development is driven by short-term economic interests, potentially sidelining ethics as well as social and environmental impacts. For this reason, strengthening values-based education and the socialization of Pancasila remain relevant as foundations for public moral orientation in a modernizing society.

Challenges in Applying Pancasila Values to Technology

A major challenge is the incentive bias within innovation ecosystems, particularly the tendency of some technology businesses to prioritize profit over ethical considerations and sustainability. This is not merely a moral dilemma but also a governance issue: without ethical standards and accountability mechanisms, innovation can exacerbate inequality and widen social vulnerability. At the same time, the literature suggests that corporate responsibility can align with economic performance and support sustainable development, meaning that ethics need not be positioned as an obstacle to innovation (Vărzaru et al., 2021).

Another challenge is the operational understanding gap among policymakers and practitioners regarding how to translate Pancasila into concrete decision criteria for technology. Values often remain at the level of general norms rather than becoming actionable principles guiding design choices, risk evaluation, research priorities, and impact indicators. In addition, regulatory instability or weak cross-institutional coordination may undermine consistent implementation of Pancasila-oriented governance in practice.

Recommendations for Integrating Pancasila in Technology Development

Based on the review, three strategic recommendations are proposed. First, strengthen ethics-of-technology education and training grounded in Pancasila, especially for future scientists, engineers, and digital practitioners, with practical competencies such as social impact assessment, risk mitigation, and values-based decision-making. Second, the government should reinforce policy instruments and incentives (e.g., research funding, innovation evaluation schemes, and public procurement standards) that reward technologies demonstrably aligned with fairness, safety, inclusion, and environmental sustainability. Third, meaningful integration of Pancasila requires cross-sector collaboration among government, academia, industry, communities, and civil society organizations. Such collaboration is important because cross-sector collaborations pool information, resources, activities, and capabilities across organizations to achieve outcomes that cannot be achieved by actors working alone (Bryson et al., 2006). With this synergy, Indonesia's S&T development can better align with Pancasila values while generating broad and tangible benefits for society.

Conclusion

This study concludes that Pancasila can serve not only as Indonesia's philosophical foundation but also as a practical values framework for guiding science and technology development toward ethical, inclusive, and sustainable outcomes. When translated into operational principles, the five pillars of Pancasila provide clear direction for ensuring that innovation respects human dignity, promotes social justice, strengthens national cohesion, and supports participatory and accountable governance. In this sense, technological progress should be assessed not merely by technical performance or economic returns, but also by its social value, equity impacts, and long-term contribution to public welfare.

At the same time, the study highlights major barriers to implementation. Technology development is often driven by short-term economic incentives that can weaken ethical considerations and overlook social or environmental consequences. Another challenge is the limited capacity among policymakers and practitioners to convert values into concrete decision criteria, standards, and evaluation metrics. Regulatory inconsistency and fragmented coordination across institutions further reduce the effectiveness of values-based technology governance.

To strengthen integration of Pancasila in science and technology strategy, this study recommends three key directions: reinforcing Pancasila-based ethics education and professional training for scientists and technology practitioners; aligning policy instruments and incentives with values-based innovation goals, such as funding priorities, evaluation indicators, and public procurement standards; and institutionalizing cross-sector collaboration among government, academia, industry, communities, and civil society to ensure that Pancasila values are embedded throughout the technology lifecycle. Future research should test and refine these strategic directions through empirical case studies and the development of measurable indicators that can monitor how far innovation outcomes align with Pancasila values. Overall, positioning Pancasila as the basic values foundation offers Indonesia a culturally grounded pathway to pursue technological advancement that is not only competitive but also socially legitimate, equitable, and sustainable.

List of abbreviations

Not applicable

Acknowledgment

Not applicable

Declaration

The author declares that there is no conflict of interest regarding the publication of this article.

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

Not applicable

Competing interests

All authors declare that there are no relevant conflicts of interest related to this research.

Author contributions

JJ responsible for the conception and design of the study, MA collection data, manuscript writing, II and MP analysis, and interpretation. All author also reviewed and approved the final version of the manuscript

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